

## CLAIMS

### **We Claim:**

1. A BGA package, which comprises:
  - 5 a substrate having a front side and a back side;
  - a die attachment region formed on the front side of the substrate;
  - an electrically conductive first power ring that includes a plurality of spaced apart conductive first ring segments formed on the front side of the substrate, the first ring segments being arranged around the die attachment region;
  - 10 an electrically conductive second power ring that includes a plurality of spaced apart conductive second ring segments formed on the front side of the substrate, the second ring segments being arranged around the die attachment region and positioned at a greater distance from the die attachment region than the first ring segments;
  - 15 a plurality of vias penetrating through the substrate, including: a subgroup of first vias which are connected to the first ring segments of the first power ring; and a subgroup of second vias which are connected to the second ring segments of the second power ring;
  - a semiconductor die mounted over the die attachment region on the front side of the substrate, the semiconductor chip having a plurality of bond pads; and
  - 20 bonding wires for connecting the plurality of bond pads of the die to associated first ring segments and second ring segments.
2. The BGA package of claim 1, further including a third conductive ring arranged around the die attachment region and positioned at a closer distance to the die attachment region than the first and second power rings.
3. The BGA package of claim 2, wherein the third conductive ring is a ground ring.

30

4. The BGA package of claim 3, wherein the ground ring is formed of a plurality of spaced apart conductive ground ring segments, at least some of the ground ring segments being independently grounded.
5. The BGA package of claim 1, wherein each of the first ring segments of the first power ring and each of the second ring segments of the second power ring comprise separate power sources.
10. The BGA package of claim 1, wherein the plurality of spaced apart conductive first ring segments are arranged in staggered configuration relative to the plurality of spaced apart conductive second ring segments.
15. The BGA package of claim 6, wherein the each of the first ring segments includes a conductive tab that electrically connects the first ring segments to at least some of the first vias; and  
wherein the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.
20. The BGA package of claim 6, wherein the each of the first ring segments is connected to at least two of the first vias.
25. The BGA package of claim 8, wherein the each of the first ring segments includes a conductive tab that electrically connects each first ring segment to an associated one of the the first vias; and  
wherein the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.
30. The BGA package of claim 8, wherein the first ring segments of the first power ring are larger than the second ring segments of the second power ring.

11. A BGA package as in Claim 1 further including an encapsulation layer which protectively encases the front side of the substrate enclosing at least a portion of the semiconductor die and the bonding wires; and

5            a plurality of solder balls formed on the back side of the substrate, at least some of the solder balls being electrically connected to the vias.

12. A BGA package as in Claim 1 wherein the first power ring includes sixteen (16) spaced apart conductive first ring segments; and

10            wherein the second power ring includes sixteen (16) spaced apart conductive second ring segments.

13. A BGA package as in Claim 1 wherein the first power ring includes twenty four (24) spaced apart conductive first ring segments; and

15            wherein the second power ring includes twenty (20) spaced apart conductive second ring segments.

14. A method for providing a plurality of power sources to a semiconductor die mounted in a BGA package including: a die positioned on the front side of the substrate; an electrically conductive first power ring with a plurality of spaced apart conductive first ring segments formed on the front side of the substrate so that the first ring segments are arranged around the die; an electrically conductive second power ring with a plurality of spaced apart conductive second ring segments formed on the front side of the substrate so that the second ring segments are arranged around the die at a greater distance from the die attachment region than the first ring segments; a plurality of vias penetrating through the substrate, including: a subgroup of first vias which are connected to the first ring segments of the first power ring; and a subgroup of second vias which are connected to the second ring segments of the second power ring; the die having a plurality of bond pads formed thereon, the method comprising:

                  providing each of the first ring segments and second ring segments with an independent power source; and

connecting the bond pads of the die to associated ones of the first ring segments and second ring segments.

15. A BGA package, which comprises:
  - 5 a substrate having an integrated circuit die mounted on the front side of the substrate;
    - an electrically conductive first power ring that includes a plurality of spaced apart conductive first ring segments formed on the front side of the substrate around the die;
  - 10 an electrically conductive second power ring that includes a plurality of spaced apart conductive second ring segments formed on the front side of the substrate, the second ring segments also being arranged around the die;
    - an electrically conductive ground ring formed on the front side of the substrate around the die;
  - 15 a plurality of vias penetrating through the substrate, including: a subgroup of first vias which are connected to the first ring segments of the first power ring; a subgroup of second vias which are connected to the second ring segments of the second power ring; and a subgroup of ground vias which are connected to the ground ring; and
  - 20 bonding wires for connecting the die to the first ring segments, second ring segments, and ground ring.
16. The BGA package of claim 15, wherein at least some of the first ring segments and the second ring segments provide independent power sources to electronic systems contained within the die.
- 25
17. The BGA package of claim 16, wherein the plurality of spaced apart conductive first ring segments are arranged in staggered configuration relative to the plurality of spaced apart conductive second ring segments.

18. The BGA package of claim 17, wherein the each of the first ring segments includes a conductive tab that electrically connects the first ring segments to at least some of the first vias; and

5       wherein the conductive tabs of the first ring segments are arranged so that they pass through spaces between the plurality of spaced apart conductive second ring segments.

10      19. The BGA package of claim 15, wherein the ground ring is formed of a plurality of spaced apart conductive ground ring segments, at least some of the ground ring segments being independently grounded.

20. The BGA package of claim 15, wherein at least a portion of the die and bonding wires are contained within an encapsulant.